TRANSLATION

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(71) Applicant:
Wirkbau Textilmaschinen GmbH, Chemnitz, Germany

(74) Representative:
M. Schneider, Patent Attorney, Chemnitz

(72) Inventor:
Frank Schubert

(56) References:
DE 29 19 344 C2, DE 31 27 450 A1, DD-PS 2 42 245
DD-PS 2 07 941, SU 13 08 659, SU 12 91 628

(54) Title:
PROCESS AND APPARATUS FOR PRODUCTION OF MULTICOLORED JACQUARD-PATTERNED PILE KNIT FABRICS

Summary:

The invention concerns a process and an apparatus for the production multicolored jacquard-patterned pile knit fabrics where the pattern forming pile threads are attached to the base knit fabric preferably in a weft pattern and the non-pattern-forming pile threads are held predominantly stretched on the base knit fabric, and during the knitting process the pile thread group is moved in closed streets/alleys of a guide comb in the lifting and shifting direction, and the chosen pattern-forming pile threads controlled by pile thread guides form a shed with the non-pattern forming pile threads, are fed by the guide comb in a first trip to an inlayer/inserter for precise shifting for underlaying, the pattern-forming pile thread also laid

under in the second or return trip after another shift is tied in, guided in the alley of the guide comb back to the dead pile string, and after a new pattern-forming pile thread is chosen, the process begins again with shed forming by the new pattern-forming pile thread. For the purpose of increasing the operating speed of the machine the chosen pattern-forming pile thread immediately after being grasped by the needle is guided back within the first trip, the chosen pattern-forming pile thread is also laid under in the second trip by lowering the guide comb, and the pattern-forming pile thread newly selected for the following cycle is selected somewhere between the knocking over of the mesh in the first trip and the beginning of the underlaying in the second trip, and somewhere after the beginning of the underlaying of the second trip...

Description

The invention concerns a process for the production of a multi-colored jacquard-patterned pile knit fabric consisting of a base knit fabric and a pattern-forming pile thread system in which the pattern-forming pile threads on the pile knit fabric are attached to the base/backing knit fabric preferably in the weft design and the non-pattern-forming pile threads are held on the base/backing knit fabric, the pile threads are assigned in groups each to a mesh rod and during the knitting process the pile thread group in the closed alleys of a guide comb can move in the lifting and shifting direction and the selected pattern pile threads controlled by pile thread guides form a shed with the non-pattern forming dead pile threads, are fed to an inlayer in a first trip by the guide comb for exact shifting for underlaying, the inlayer throws off the underlaid pattern pile threads during the setting, the pattern-forming pile threads also underlaid in the second or return trip after another shifting, are tied in, guided back in the alley of the guide comb to the dead pile string and after the new selection of a pattern pile thread the process begins again with shed forming by the new pattern-forming pile thread.

Through DD Patent 242 245 a pile knitting machine has become known which is equipped with a horizontally arranged row of slide needles, with pile sinkers, with a weft-laying mechanism behind the pile sinkers and a knitting thread guide oscillating in front of the needle head.

The bunch of pile threads, divided into groups, is guided into alleys by a guide comb, at which time the non-pattern forming threads -- also called dead pile threads -- are guided in a shed plane near the pile sinkers and the pattern-forming pile threads in each case are guided in a second shed plane remote from the pile sinkers.

Individually movable pile thread guides, which are controlled in the conventional manner by a jacquard machine to form sheds, prepare the shed for the independent controlling of pattern pile and dead pile.

An inlayer which is capable of moving below the sinkers of the guide comb and above the plane of the needles vertically in the shifting direction and also in the needle longitudinal direction has a hook which is open at the top and bottom. It grasps the pattern-forming pile thread by a corresponding movement and can lay it under both in the first trip of a neighboring needle or lay it over in the hook.

When the mesh is knocked over in the first trip the inlayer holds the pattern-forming pile thread and therefore can also undertake the underlaying or overlaying in the second or return trip.

Once this process is completed, this inlayer releases the pattern-forming pile thread by a corresponding movement.

This pattern-forming pile thread can now be guided back to the bunch of dead piles.

A new pattern-forming pile thread is selected and brought into the front shed plane to form a shed.

This procedure is very unfavorable in terms of the performance parameters of the machine.

After grasping the pattern pile thread by the needle in the second trip the inlayer is initially aligned very precisely in a certain position to the sinkers of the guide comb for return guiding the pattern-forming pile thread.

This requires a lot of time and entails a large amount of uncertainty, because precisely in this phase the pattern-forming pile threads -- due to the knocking over movement of the needles and the formation of the pile loops -- are also very strongly loaded on the sides.

The inlayer and the sinkers of the guide comb are deflected sideways.

The subsequently available angle of rotation for return guidance of the pattern pile thread, for the new choice by the jacquard machine, for the new shed formation, for the renewed grasping of the pattern pile thread by the inlayer up to the shifting and underlaying of the pattern pile thread is so narrowly dimensioned that a suitable operating speed and therefore productivity of the machine cannot be assured under industrial conditions.

Besides the above cited patent, other patents also describe a large number of very similar process variants for choosing and setting of pattern pile and dead pile during the production of jacquard-patterned pile knits.

As examples here one can refer to DD patents 140 767, 153 399, 207 941 and 136 986.

In all the processes disclosed there the same negative phenomena occur in terms of the concentration of functionally important movements of the machine-forming elements in a narrowly limited angular range.

To improve the collaboration between the sinkers of the guide comb and the inlayer, the inlayer is equipped with an upwardly directed projection which always remains engaged with the second alley of the guide comb (DD patent 1 56 330). With this a frequently desired independent displacement of the guide comb and inlayer are actually sacrificed for functional reasons.

The production of a pile knit, e.g., according to DD-P 2 07 941 was indeed possible in principle by the process subject to such conditions and with such an apparatus, but the productivity of the pile knitting machine was strongly limited. Above all in the case of larger operating widths -- up to 4 meters -- neither the process nor the apparatus can be used.

Special problems arise with the known procedures, above all when the pattern-forming pile threads are attached to the base knit fabric in the pile material-saving weft design.

The reason for this is that in these procedures the newly selected pile thread is already moving at a very early point in time in the first trip following the selection process and must be brought into the underlaying position.

The purpose of the invention is to increase the operating speed of the pile knitting machine with high reliability also for realizing multicolored weft designs.

The purpose of the invention consists in finding a process which, depending on a continuously oscillating needle movement, has sufficient time available for the return guidance

of the pattern pile, for the new shed formation according to the pattern, and for grasping, shifting and underlaying the new pattern pile thread.

The apparatus for executing the process should assure a secure collaboration of guide comb and inlayer and at high frequency of mesh formation also make possible the underlaying of the pattern pile and the appropriate setting of pattern pile and dead pile -- relative to the reference needle.

According to the invention this problem is solved by the process steps of the characterizing part of the first claim.

The extrapolation of the function of laying the pattern-forming pile thread under the needles in the second trip from inlayer to the guide comb makes it possible already at the beginning of the setting process in the first trip to guide the selected pattern-forming pile thread back to the group of dead piles and to initiate the new choice and shed formation.

Through this measure it is possible to establish the working speed of the machine almost independently of the choice of pattern.

The movements of grasping the pattern-forming pile thread by the inlayer in the first trip and its shifting and underlaying motion independent of the guide comb may be configured according to the optimal laws of motion.

The configuration of the process in claims 2 and 3 assures a secure laying of the pattern-forming pile thread in the range of movement of the inlayer without unfavorably influencing the different bindings of pattern pile and dead pile.

The configuration of the device according to claim 4 assures the undisturbed collaboration of guide comb and inlayer, especially in the case of restoration of the initial position for feeding and grasping the new pattern-forming pile thread.

Deflections of the sinkers of the guide comb and uncontrollable oscillations are avoided by this configuration.

Special safeties for introducing the inlayer into the second alley of the guide comb are assured by the configuration in claim 5.

The manner of insertion of the connecting pieces for the lowest mass of the guide comb and low operating costs for production are described in claim 6.

Claim 7 describes an advisable configuration of the guide comb which has the individual holding sockets.

This above described process and the apparatus constructed for it for the first time permits under industrial conditions a pile knit to be produced in the width adapted to the requirements in which the pattern-forming piles are laid under two needles in alternating directions over pile sinkers and the dead piles are stretched in a neighboring alley to this pair of needles and are laid down loosely under the pile lugs/ears located there.

This device also permits the production of a pile knit in which the dead piles are tied in as a so called standing weft in a mesh rod involved in pile formation.

The apparatus with suitable configuration of the driving elements can be used for practically any operating mode.

A large number of weft designs as well as mesh binding of the pattern piles can also be realized.

Pile formation in every second row, according to DD patent 141 687, in which the mesh of the pattern-forming pile thread must not be pulled over the weft of the base fabric can also be realized with this device.

The invention will be explained in the following by way of an example of embodiment. In the corresponding drawings:

Figure 1 shows a cross-section through the mesh forming zone of a pile knitting machine,

Figure 2 is a cross-section through the guide comb along line II-II in Fig. 3,

Figure 3 is a section through the guide comb along line III-III in Fig. 2,

Figure 4 is a laying pattern of a first pile fabric which can be produced by the process described,

Figure 5 is a detailed view of the pile knit according to Fig. 4 cut in the weft direction,

Figure 6 is a laying pattern of a second variant of the pile knit produced according to the process,

Figure 7 is a detailed view of the knit fabric according to Fig. 6 in a section representation parallel to the weft direction, and

Figure 8a through 8f are schematic representations of the collaboration operating elements for guiding and fabricating a pile thread group in six consecutive positions in the two-trip operating mode.

The pile knitting machine is equipped with a horizontally arranged needle bar. It has needles which are preferably designed as slide needles. Their slides are mounted in a separate bar and can be driven.

Above the backing-off/knocking over plane a weft thread guide 3 is positioned which can be raised and lowered and moved in alternating directions over several needle divisions.

In front of the knocking-over plane stationary pile sinkers 2 penetrate the needle alleys.

A conventional knitting thread guide 4 oscillates rhythmically in front of the needle plane and is capable of laying its knitting threads 41 in the needle hooks in the cycle of mesh formation.

Between this knitting thread guide 4 and the bar of the pile sinkers 2 elements for pile thread insertion and laying are arranged.

The pile threads 5 are all inserted above the needle plane. The pile threads 5 of one group which are assigned either to a needle division or to a reference needle 10 are fed by pile thread guides 6a. 6b. The pile thread guides 6a, 6b are individually movable approximately in the division plane of the needles.

The initial position and the selector position of the pile thread guide 6a, 6b is situated near the bearing 70 of the sinkers 71, 72 of the guide comb 7. The pile threads 5 guided there by the pile thread guides 6a are tied in as non-pattern-forming pile threads 5a (dead piles).

The pile thread guide 6b according to the pattern selected by a jacquard machine, not shown, with its pile thread 5b is swiveled out toward the operating side of the machine,

forming a shed. At the time of the grasping of this pile thread 5b by the inlayer 8 it is situated in the alley 75 on the spacer 73.

All pile threads 5a, 5b of a group are guided in a first alley 75 of the guide comb 7 also in the region of the opened shed (5a,5b).

The first alley 75 bounded by sinkers 71, 72 shields the pile threads 5a, 5b against the needle points 1 and against the temporarily penetrating points of the inlayer 8.

The point of the inlayer 8 extends in the space between the plane of the dead pile threads 5a and the plane of the pattern-forming pile threads 5b.

By shifting the guide comb 7 above the needle plane (1) the pattern pile threads 5b selected in each case pass obliquely under the throat of the inlayer 8 and can lay this pile thread 5b independently of the shifting movement of the guide comb 7 under a needle 1 or insert it in its hook.

The variant of the guide combs 7 shown enlarged in Fig. 2 and 3 assumes that for guidance of the dead pile bunch 5a of a group in the first alley 75 a relatively large space must be present which is shielded securely against the range of movement of the needle point (1).

The step-shaped configuration of alleys 75, 76 offers the condition for satisfying this requirement.

Upon each new choice of the pattern-forming pile thread 5b, for the purpose of shed formation, the pattern-forming pile thread 5b must be pulled out of the strand of dead piles 5a.

The expanded space in the first alley 75 of the guide comb 75 is also sufficient for this. In the region opposite the first alley 75 a smaller width of the alley 75 is sufficient. It need only be wide enough that it assures passage for a single thread, if necessary with knots.

The space thus gained in the front region is made available temporarily to the inlayer 8 dipping into the second alley 76.

To avoid oscillations of the sinkers 71, 72 of the guide comb 7, besides the spacer 73 for closing the first alley 75 on the front side connecting pieces 74 are also provided for spacing the second alley 76.

The connecting pieces 74 are arranged wherever neither needle 1 nor inlayer 8 have to be moved.

By this configuration of the free ends of the sinkers 71, 72 of the guide comb 7 the same are stabilized in the collaboration with the bearings 70 of the sinkers 71, 72 in such a way that they can securely withstand even high lateral thread tensile forces which may occur during the formation of the pile loops.

In the following the individual process steps of selection and laying of a pile thread group which are assigned to a reference needle 10, a reference pile sinker 20 and a reference alley 750 in the guide comb 7 will be described with reference to Fig. 8a through 8f.

The needles 1 are all situated in the knocking over/backing- off position (dash-dot-dash-line). The guide comb 7 is represented by a segment of two pairs of sinkers 71, 72, where the first reference alley is designated 750 and the second reference alley 760. The other neighboring elements are omitted for better clarity of demonstration.

The first reference alley 750 is in the plane of the pile sinker 2 adjacent to the reference pile sinker 20 on the right and also to the right of the reference needle 10.

The pile threads 5 extend from the reference alley 750 around the pile sinkers 2 up to the region of the finished pile knit fabric (broken line).

The pattern pile thread 5b is swiveled out forward inside the alley 750. With the dead piles 5a within the reference alley 750 it forms a shed as Fig. 1 shows.

For the purpose of transferring the pile thread 5b selected for patterning to the inlayer 8 the guide comb 7 is moved to the left about 3 to 4 needle divisions (Fig. 8b).

The inlayer 8 follows this movement and swivels down at the end of this stroke. The inlayer 8 therefore receives the pattern-forming pile thread 5b.

The guide comb 7 moves away over the inlayer 8 back to its initial position (Fig. 8c).

Now the guide comb 7 and the inlayer 8 are lowered. At this time the guide comb 7 presses the dead piles 5a with its edge facing toward the pile sinkers 2 below the needle plane so that the needles 10, 1 can be moved via this dead pile string 5a through the alley between the pile sinkers 20, 2.

The inlayer 8 has also reached its lowest position in the meanwhile. The reference needle 10 crosses the pattern-forming pile thread 5b first and is followed by the nearest neighboring needle 1.

As soon as the second needle 1 can guide the pattern-forming pile thread 5b with its back, the inlayer 8 rises over the needle plain and begins the movement in its reference alley 760 in the guide comb 7 (Fig. 8d).

At this time the selected pattern-forming pile thread 5b and with it, its pile thread guide 6b, can already begin its backward movement toward the selection position.

The knitting thread guide 4 now lays its knitting threads 41 in the needle hook. This is advantageously accomplished in the form of a closed fringe laying. The knocking-over/backing-off movement of the needle 1 in the first trip can begin with the needle hook closed.

After completion of the knocking-over/backing off movement the reference alley 750 of the guide comb 7 is again in the initial position in front of the described pile sinker 2.

The guide comb 7 is lowered so that all pile threads 5a, 5b guided by it are located in the underlaying position (Fig. 8e).

In the meantime the pattern-forming pile thread 5b guided by the pile thread guide 6b has reached the selection position.

The not-shown jacquard machine selects a new pile thread guide 6b. The opening of the shed with the newly selected pile thread 5b may if necessary begin already in the position shown in Fig. 8e.

The needle after the renewed insertion of the knitting thread 41 into the needle hook in the meanwhile has almost reached the backing-off plane in the second trip again, it throws off the mesh formed in the first trip from the knitting thread 41 and thus completely encloses the pattern-forming pile thread 5b -- forming a loop guided over the pile sinker -- on the base fabric between needle mesh and sinker mesh.

The process described can begin again at this place.

In Fig. 4 through 7 two examples of a pile knit fabric with their laying patterns and a detailed view in which the pile knit fabric was cut over three mesh rods in the weft direction (Fig. 5 and Fig. 7) are shown.

The laying pattern according to Fig. 4 is characterized by the fact that the non-pattern-forming pile threads always remain in one alley which is immediately adjacent on the outside to the needles 1 involved in the pattern-forming of its pile threads 5a, 5b.

These non-pattern-forming piles threads 5a are essentially loose and stretched under the pile lugs formed in this alley.

This type of tying in of the dead piles 5a has the advantage that these dead piles 5a do not interfere with the setting of the pattern-forming piles 5b and that no alleys are formed between the pile rows in the warp direction.

In the region of the right edge of the fabric of the carpet the dead piles 5a can be covered by a pile thread 5b always patterned in the same color.

If for certain reasons a patterning is necessary up to the edge, there a laying is provided according to Fig. 6. An additional differently controlled inlayer (not shown) there can move the dead piles 5a in every other trip under a needle to the left.

The advantage of this operating procedure according to the invention is based on the fact that the guide comb 7 with its sinkers 71, 72 between which all pile threads 5 are constantly guided can also lay down the pattern pile 5b in the second trip.

It is of no consequence, within limitations, in what position relative to the shed this pattern-forming pile thread 5b is located inside the alley 75. The decisive factor is that the guide comb 7 is lowered and also that pattern-forming pile thread 5b when passing through

the needles 1, 10 is positioned by the pile sinker alley below the needle plane in such a way that both the second needle 1 as well as the reference needle 10 can pass over said pattern pile thread 5b away into the driving-out position.

A complete revolution of the main shaft of the pile knitting machine is available for the selection process of a pile thread 5 including the return guidance of the previously selected pile thread 5b.

Another approximately half trip can then be devoted to grasping the selected pattern-forming pile thread 5b by the inlayer 8 and the exact positioning of the guide comb 7 and inlayer 8 in the preassigned needle alley and for underlaying.

In this way the movements necessary for the working elements may be configured in such a way that the highest operating speeds can be reached.

As opposed to the above described process for feeding the selected pattern-forming pile thread 5b to the inlayer 8 with horizontal shifting of the guide comb 7 one may also raise the guide comb 7 by such an amount that the easily lowered inlayer 8 moving relative to the guide comb 7 in the shifting direction grasps the pattern-forming pile thread on the side and deflects it to the side and lays it under the preassigned needles 1.

This process is simpler in terms of the forms of movement of the inlayer 8 and the guide comb 7 but it loads the latter due to the multiple deflection of the pile thread 5b and the inlayer 8 more strongly than in the case described.

An optimum in practice can certainly be arrived at through a combination of these two possibilities.

The apparatus described naturally can also be used to tie the pile thread in the form of mesh into the base fabric.

In this case, however, one must accept in the bargain the fact that the return guidance of the pattern-forming pile thread or its pile thread guide into the selection position can only begin after the insertion of the pattern-forming pile thread into the needle hook during the second trip.

This later beginning of the pattern selection is certainly acceptable, because the insertion of the pattern pile into the needle hook during the next first trip may be carried out at a substantially later time.

In this case also acceptable operating speeds are achieved.

List of reference numbers

1	needle
10	reference needle
2	pile sinkers
20	reference sinker
3	weft thread guide
31	weft thread
4	knitting thread guide
41	knitting thread
(5)	pile threads
5a	pile thread non-pattern forming (dead pile)
5b,5b'	pile thread pattern forming (pattern pile)
(6)	pile thread guide
6a	pile thread guide (non-pattern forming)
6b	pile thread guide (pattern forming)
7	guide comb
70	bearing
71	separating sinker
72	guide sinker
73	spacer
74	connecting pieces
741	connecting piece (edge)
8	inlayer

Claims

1. Process for production of multi-colored jacquard-patterned pile knits consisting of a base knit fabric and a pattern-forming pile thread system,

in which on the pile knit fabric

- the pattern-forming pile threads are attached to the base knit fabric preferably in a weft design,
- the non-pattern-forming dead pile threads are held on the base knit fabric and
- the pile threads are assigned in groups each to a mesh rod,

and during the knitting process

- the pile thread group can be moved in the closed alleys of a guide comb in the lifting and shifting direction and
- the selected pattern pile threads
- controlled by pile thread guides form a shed with the non-pattern-forming pile threads,
- are advanced by guide comb in a first trip to an inlayer for exact shifting for underlaying,
- the inlayer throws the underlaid pattern pile threads off during setting,
- the pattern-forming pile thread
- in the second or return trip also underlaid after reshifting is tied in,
- is returned to the selection position in the alley of the guide comb, and
- after the new choice of a pattern pile thread the process begins again with shed forming by the new pattern pile thread.

characterized by the fact

that the pattern pile thread selected

- immediately after being grasped by the needle
- within the first trip begins the return motion to the selection position

that the selected pattern pile thread

- in the second trip
- is underlaid by lowering the guide comb, and

that the pattern pile thread newly selected for the following cycle

- approximately between the knocking-over/backing-off of the mesh in the first trip in the beginning of the underlaying in the second trip
- is selected by the jacquard machine and
- approximately after the beginning of the underlaying of the second trip is brought by its pile thread guide into the shed plane of the pattern-forming pile thread.

2. Process as in claim 1 characterized by the fact that the newly selected pattern pile thread

- is fed from the guide comb by a horizontal shifting movement obliquely toward the inlayer and
- the inlayer independently of the movement of the guide comb executes the underlaying of a pattern pile thread.

3. Process as in claim 1 characterized by the fact that the guide comb is guided upward relative to the inlayer.

that the inlayer grasps the pattern pile thread by a lowering and shifting motion, moves and underlays it.

4. Pile knitting machine for execution of the process according to claims 1 through 3 containing

- a row of needles, a row of pile sinkers, weft layers and a knitting thread guide bar,
- a number of pile thread guides per needle alley which can be shifted individually within their needle alley to form sheds,
- a guide comb for limited guidance of the pile thread shed for each group of pile threads, in which case the guide comb,
- with a first alley for the shed of the pile threads and
- with a second alley for the shielding of the pile threads from the needle points and
- both alleys are separated by sinkers, and
- an inlayer capable of lifting and moving for grasping and guiding the selected pattern pile threads,
- which can be inserted into the second alley of the guide comb
- can be lowered below the needle plane and
- can be moved between needle plane and guide comb over at least two needle divisions,

characterized by the fact

that the sinkers (71, 72) of the guide comb (7)

- which separate the first and second alley (75,76) from one another, are connected to each other
- beyond the second alley (76)
- at a distance from the bearing (70) of the sinkers (71,72) of the guide comb (7)
- outside of the range of motion of needle (1) and inlayer (8).

5. Pile knitting machine as in claim 4 characterized by the fact that the first alley (75) in the region of the dead piles (5a) is made wider than in the region of the shed plane of the pattern pile thread (5b) and

that the second alley (76) is wider in the range of movement of the inlayer (8) than in the range of movement of the needles (1).

6. Pile knitting machine as in claims 4 and 5 characterized by the fact that the connecting piece (74) on the sinkers (71,72) consists of plastic and is injection molded onto it.

7. Pile knitting machine as in claims 4 through 6 characterized by the fact that the guide comb (7) has a large number of sockets as bearings (70) for the sinkers (71,72) which can be attached and affixed to a bar and

that the connecting pieces (741) on the edge sinkers of these sockets are flatter than the connecting pieces (74) injected-molded on both sides and are connected permanently on one side only with one of these sinkers (71, 72).

(4 pages of drawings appended)

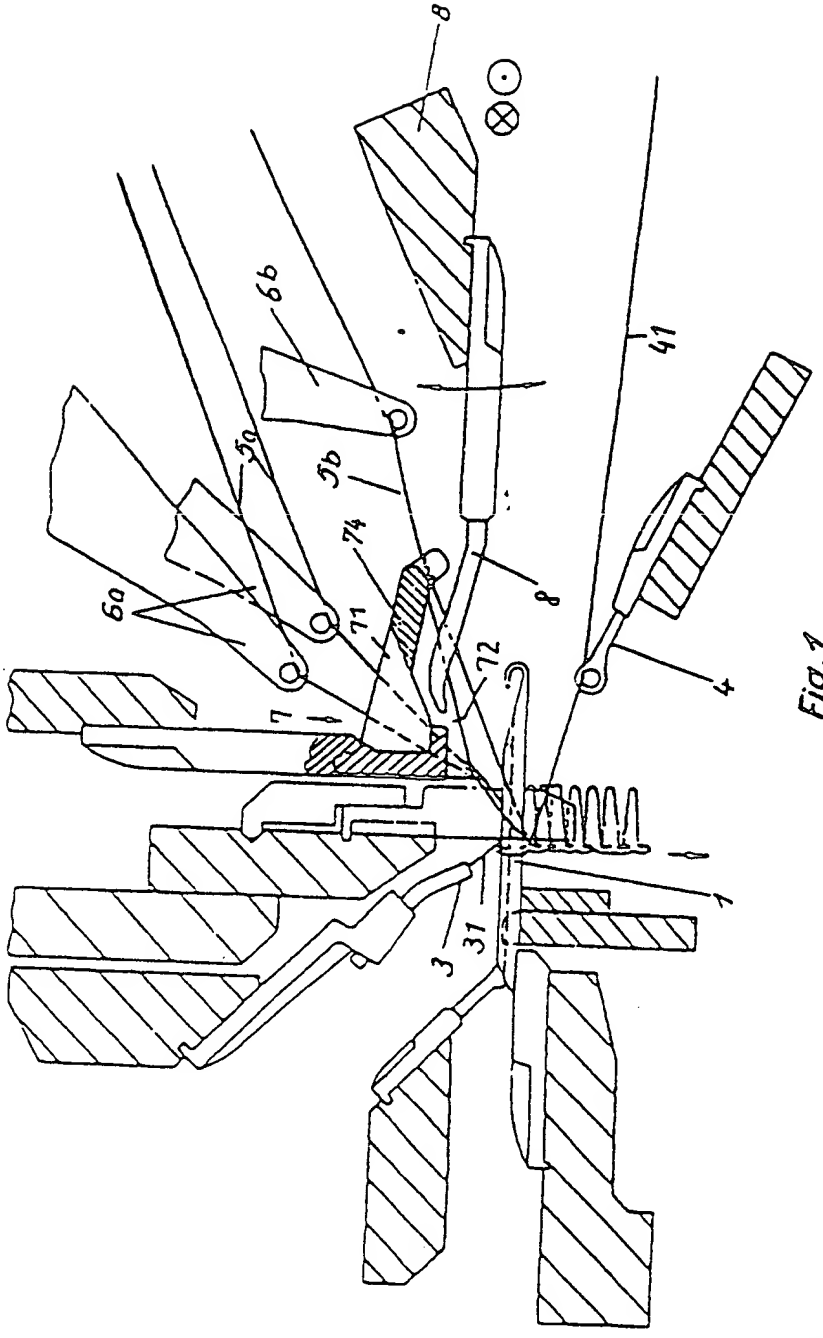


Fig. 1

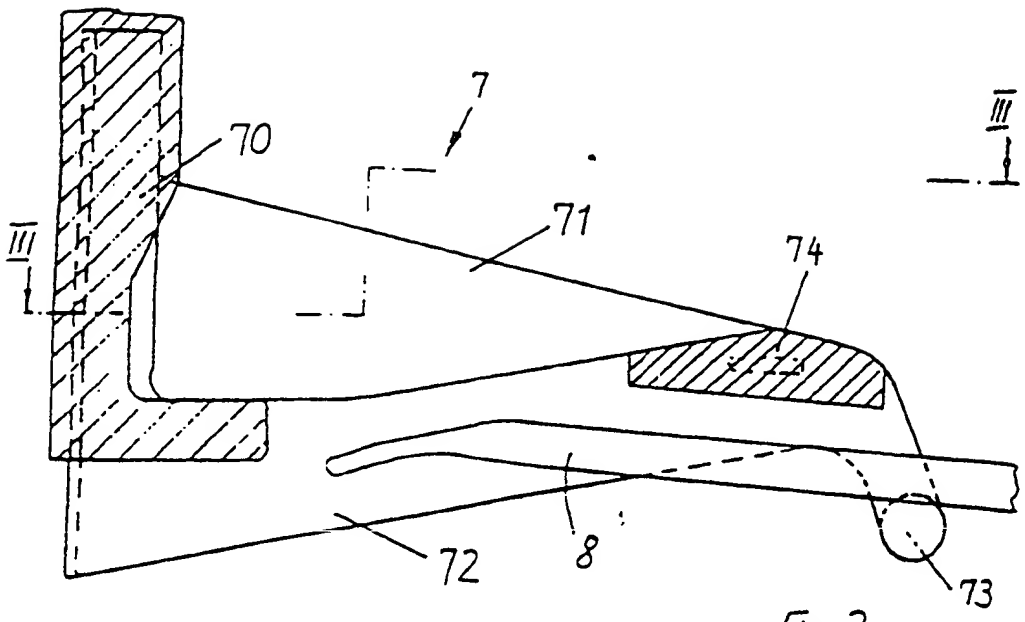


Fig. 2

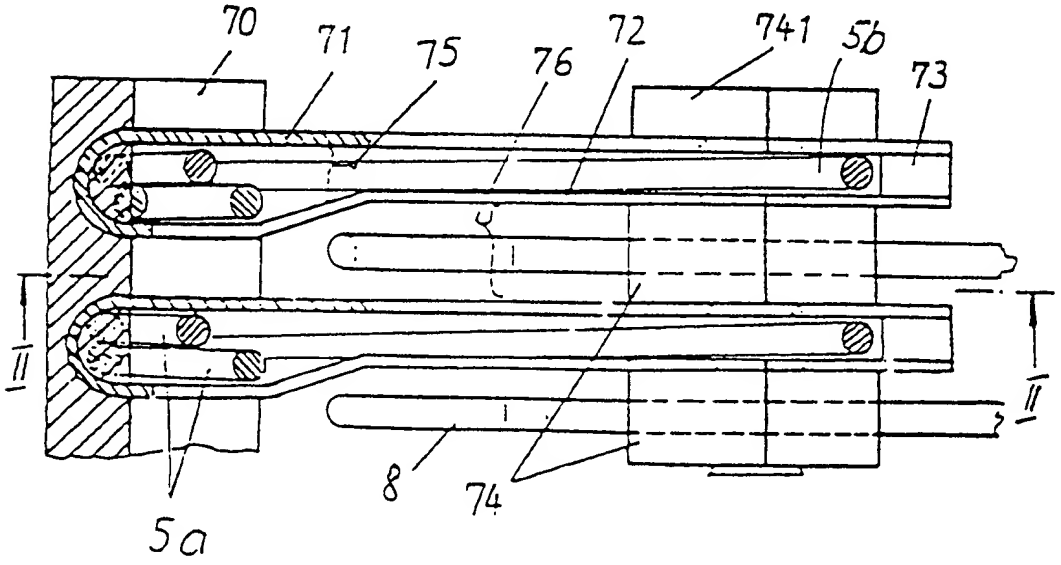


Fig. 3

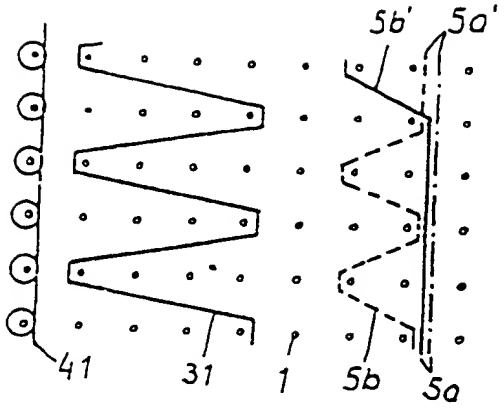


Fig. 4

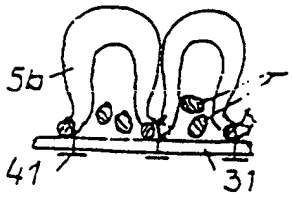


Fig. 5

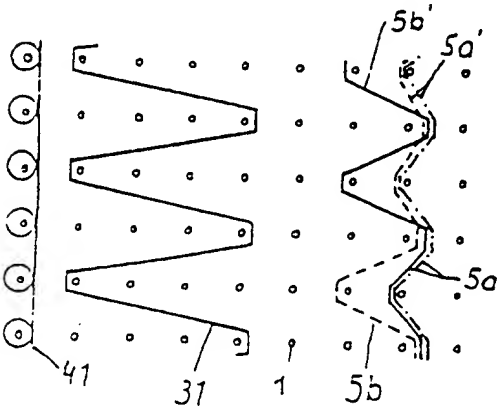
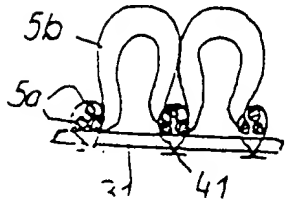


Fig. 6



Fin. 7

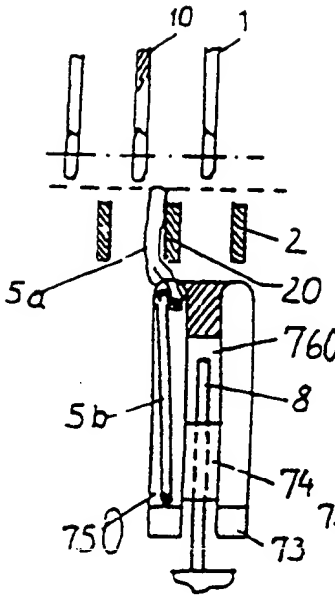


Fig. 8a

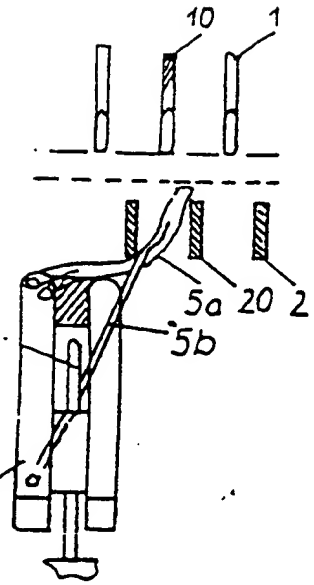


Fig. 8b

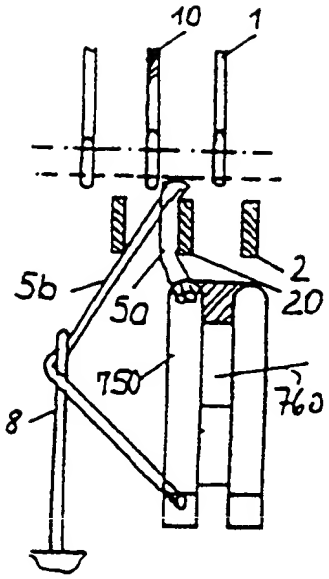


Fig. 8c

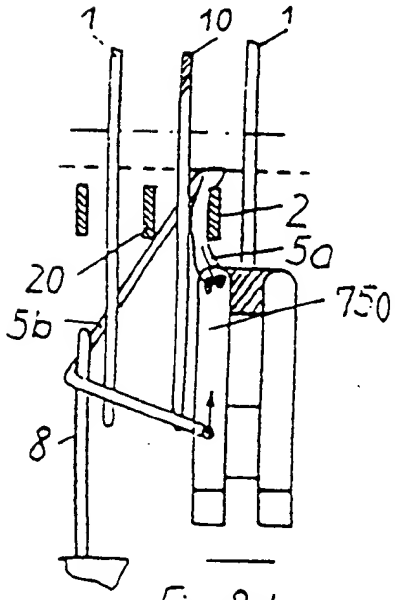


Fig. 8d

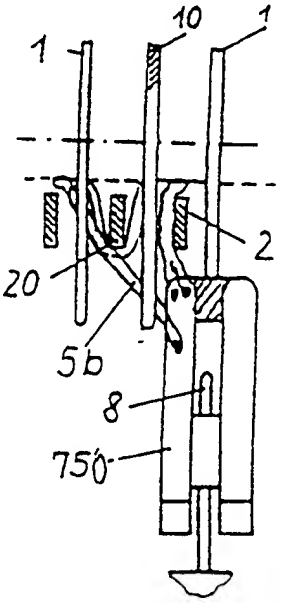


Fig. 8e

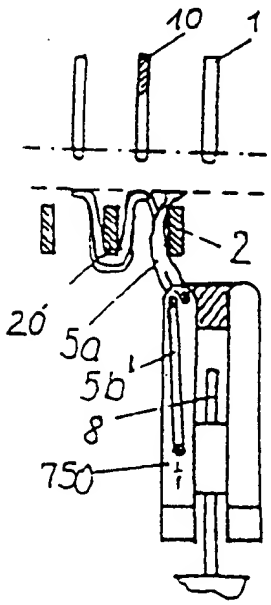


Fig. 8f

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